



Application No: GB 9828701.4  
Claims searched: 1-15

Examiner: Richard Kennell  
Date of search: 13 July 1999

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.Q): B2E (EAA, EAB, EM)

Int CI (Ed.6): -

Other: Online: WPI, EPODOC, JAPIO

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	WO 98/30748 A (FOV FABRICS), whole document	12, 13
X	US 5100168 A (HORIUCHI), whole document	12, 13
X	US 5073418 A (THORNTON), see layer 42, Figure 3	12, 13
X	US 5066039 A (SHITANOKI), see layer 24, Figures 2,4	12, 13
X	US 3705645 A (KONEN), whole document	12, 13
A	PAJ Abstract & JP 58072437 A (TIGERS POLYMER), see abstract	1-11
A	PAJ Abstract & JP 55092119 A (NITTO BOSEKI), see abstract	1-11

X Document indicating lack of novelty or inventive step  
Y Document indicating lack of inventive step if combined with one or more other documents of same category.  
& Member of the same patent family

A Document indicating technological background and/or state of the art.  
P Document published on or after the declared priority date but before the filing date of this invention.  
E Patent document published on or after, but with priority date earlier than, the filing date of this application.



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/02460

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B60R 21/16

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B60R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9830748 A1 (FOV FABRICS AB), 16 July 1998 (16.07.98) --	1-10
A	US 5259645 A (HIRABAYASHI ET AL.), 9 November 1993 (09.11.93) --	1-10
A	US 5076975 A (DAVIS), 31 December 1991 (31.12.91) --	1-10
A	EP 0535649 A1 (SHIN-ETSU CHEMICAL CO LTD), 7 April 1993 (07.04.93) --	1-10

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

## \* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

26 April 2000

Date of mailing of the international search report

27-04-2000

Name and mailing address of the ISA  
Swedish Patent Office  
Box 5055, S-102 42 STOCKHOLM  
Facsimile No. +46 8 666 02 86

Authorized officer

Hans Nordström/LR  
Telephone No. +46 8 782 25 00

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/02460

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>EP 0866164 A1 (DOW CORNING LTD), 23 Sept 1998 (23.09.98)</p> <p style="text-align: center;">-- -----</p>	1-10

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
**PCT/SE 99/02460**

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
WO	9830748	A1	16/07/98	AU	4478897 A	03/08/98
				EP	0946813 A	06/10/99
				SE	508134 C	31/08/98
				SE	9604661 A	20/06/98
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US	5259645	A	09/11/93	JP	4228338 A	18/08/92
-----						
US	5076975	A	31/12/91	US	4994225 A	19/02/91
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EP	0535649	A1	07/04/93	DE	69211935 D,T	20/02/97
				JP	2590649 B	12/03/97
				JP	5098579 A	20/04/93
				US	5254621 A	19/10/93
-----						
EP	0866164	A1	23/09/98	CN	1210170 A	10/03/99
				GB	9705524 D	00/00/00
				JP	11001876 A	06/01/99
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14 JULY 2000

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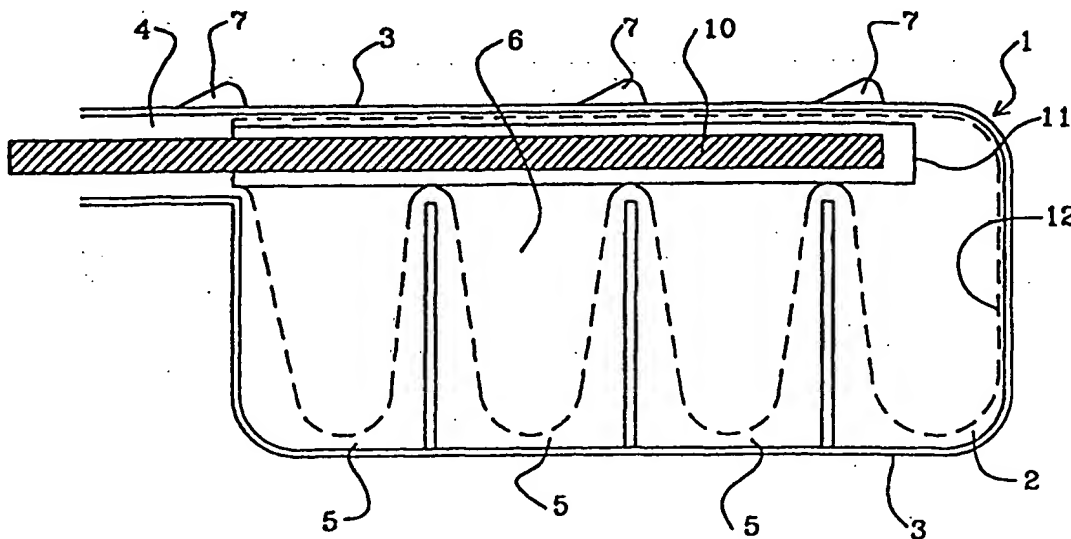


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification 7 :</b> <b>B60R 21/16</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 00/38954</b> <b>(43) International Publication Date:</b> 6 July 2000 (06.07.00)
<b>(21) International Application Number:</b> PCT/SE99/02460 <b>(22) International Filing Date:</b> 22 December 1999 (22.12.99)  <b>(30) Priority Data:</b> 9828701.4 24 December 1998 (24.12.98) GB  <b>(71) Applicant (for all designated States except US):</b> AUTOLIV DEVELOPMENT AB [SE/SE]; S-447 80 Vårgårda (SE).  <b>(72) Inventors; and</b> <b>(75) Inventors/Applicants (for US only):</b> VALKENBURG, Simon [NL/CA]; 579 Christina Crescent, Windsor, Essex, Ontario NPG 2M3 (CA). PITZER, Norbert [DE/DE]; Karl-Theodor-Strasse 28, D-85757 Karlsfeld (DE).  <b>(74) Agent:</b> MEULLER, Erik; Autoliv Development AB, S-447 83 Vårgårda (SE).		<b>(81) Designated States:</b> DE, JP, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

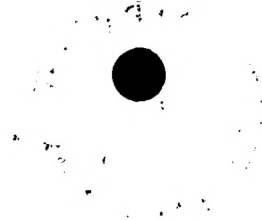
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**(54) Title:** A METHOD OF FABRICATING AN AIR-BAG AND AN AIR-BAG FABRICATED BY THE METHOD



**(57) Abstract**

In manufacturing an air-bag (1) which is formed from two super-imposed layers of fabric (2) interconnected by a plurality of seams (3), a sealant material is applied to the interior of the air-bag. The sealant material is applied by introducing a mandrel (10) carrying a parison of the sealant material (11) into the air-bag, and injecting air into the mandrel.





From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents  
United States Patent and Trademark  
Office  
Box PCT  
Washington, D.C.20231  
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 21 September 2000 (21.09.00)	
International application No. PCT/SE99/02460	Applicant's or agent's file reference DP 05518 WO
International filing date (day/month/year) 22 December 1999 (22.12.99)	Priority date (day/month/year) 24 December 1998 (24.12.98)
Applicant VALKENBURG, Simon et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:  
24 August 2000 (24.08.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☐ was  
☒ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer R. E. Stoffel Telephone No.: (41-22) 338.83.38
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DP 0 5513 WO



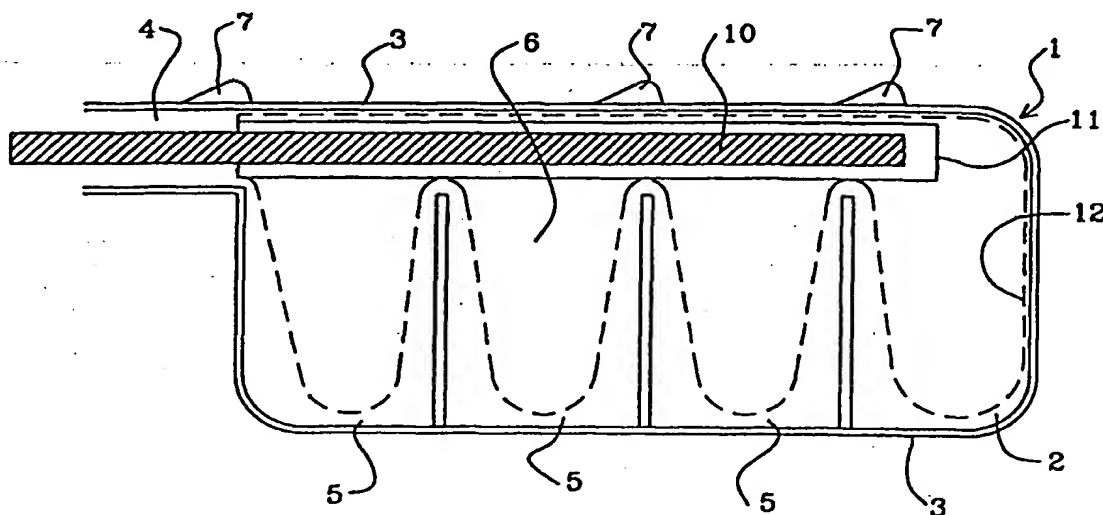
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International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>7</sup> : <b>B60R 21/16</b>	<b>A1</b>	(11) International Publication Number: <b>WO 00/38954</b>
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(21) International Application Number: <b>PCT/SE99/02460</b> (22) International Filing Date: <b>22 December 1999 (22.12.99)</b> (30) Priority Data: 9828701.4      24 December 1998 (24.12.98) <b>GB</b> (71) Applicant (for all designated States except US): <b>AUTOLIV DEVELOPMENT AB [SE/SE]; S-447 80 Vårgårda (SE).</b> (72) Inventors; and (75) Inventors/Applicants (for US only): <b>VALKENBURG, Simon [NL/CA]; 579 Christina Crescent, Windsor, Essex, Ontario NPG 2M3 (CA). PITZER, Norbert [DE/DE]; Karl-Theodor-Strasse 28, D-85757 Karlsfeld (DE).</b> (74) Agent: <b>MEULLER, Erik; Autoliv Development AB, S-447 83 Vårgårda (SE).</b>		(81) Designated States: <b>DE, JP, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</b>  <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

(54) Title: **A METHOD OF FABRICATING AN AIR-BAG AND AN AIR-BAG FABRICATED BY THE METHOD**



(57) Abstract

In manufacturing an air-bag (1) which is formed from two super-imposed layers of fabric (2) interconnected by a plurality of seams (3), a sealant material is applied to the interior of the air-bag. The sealant material is applied by introducing a mandrel (10) carrying a parison of the sealant material (11) into the air-bag, and injecting air into the mandrel.

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EE	Estonia	LR	Liberia	SG	Singapore		

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/SE 99/02460

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B60R 21/16  
According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B60R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9830748 A1 (FOV FABRICS AB), 16 July 1998 (16.07.98) --	1-10
A	US 5259645 A (HIRABAYASHI ET AL.), 9 November 1993 (09.11.93) --	1-10
A	US 5076975 A (DAVIS), 31 December 1991 (31.12.91) --	1-10
A	EP 0535649 A1 (SHIN-ETSU CHEMICAL CO LTD), 7 April 1993 (07.04.93) --	1-10

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

- Special categories of cited documents:
- "A" document defining the general state of the art which is not considered to be of particular relevance
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- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed
- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the international search  26 April 2000	Date of mailing of the international search report  27-04-2000
Name and mailing address of the ISA Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer  Hans Nordström/LR Telephone No. +46 8 782 25 00



**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
**PCT/SE 99/02460**

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
WO	9830748	A1	16/07/98	AU	4478897 A	03/08/98
				EP	0946813 A	06/10/99
				SE	508134 C	31/08/98
				SE	9604661 A	20/06/98
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US	5259645	A	09/11/93	JP	4228338 A	18/08/92
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US	5076975	A	31/12/91	US	4994225 A	19/02/91
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EP	0535649	A1	07/04/93	DE	69211935 D,T	20/02/97
				JP	2590649 B	12/03/97
				JP	5098579 A	20/04/93
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EP	0866164	A1	23/09/98	CN	1210170 A	10/03/99
				GB	9705524 D	00/00/00
				JP	11001876 A	06/01/99
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## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

3

Applicant's or agent's file reference DP 05518 WO	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/SE99/02460	International filing date (day month year) 22.12.1999	Priority date (day month year) 24.12.1998
International Patent Classification (IPC) or national classification and IPC B60R 21/16		
Applicant Autoliv Development AB et al		

- This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 3 sheets, including this cover sheet.  
☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).  
These annexes consist of a total of \_\_\_\_\_ sheets.

- This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability: citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 24.08.2000	Date of completion of this report 05.12.2000
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 40 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Hans Nordström/js Telephone No. 08-782 25 00



# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International Application No.

PCT/SE99/02460

## I. Basis of the report

### 1. With regard to the elements of the international application:\*

- ☒ the international application as originally filed
- ☐ the description:  
 pages \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the claims:  
 pages \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, as amended (together with any statement) under article 19  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the drawings:  
 pages \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the sequence listing part of the description:  
 pages \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

### 2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language English which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☒ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

### 3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

### 4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheet/fig \_\_\_\_\_

### 5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).\*\*

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.



# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International Application No.

PCT/SE99/02460

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. Statement

Novelty (N)	Claims	<u>1-10</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-10</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-10</u>	YES
	Claims		NO

### 2. Citations and explanations (Rule 70.7)

WO 9830748 A1 (FOV FABRICS AB), 16 July 1998 (16.07.98)

US 5259645 A (HIRABAYASHI ET AL.), 9 November 1993  
(09.11.1993)

US 5076975 A (DAVIS), 31 December 1991 (31.12.91)

EP 0535649 A1 (SHIN-ETSU CHEMICAL CO LTD), 7 April 1993  
(07.04.93)

EP 0866164 A1 (DOW CORNING LTD), 23 Sept 1998 (23.09.98)

The claimed invention relates to a method of fabricating an air-bag provided with a sealant layer. The object of the invention is realize a method in which an air-bag of a complex form can be coated with sealant on the inside. The solution according to the invention is that the sealant is introduced into the inside of the bag and brought into contact with the interior of the bag with a propellant gas. The claimed invention also relates to an air-bag fabricated by the method.

None of the cited documents reveals the method of fabricating an air-bag or the air-bag fabricated by the method described in the claims.

Therefore the invention according to the invention is novel. The invention according to the claims is also considered to involve an inventive step and to be industrially applicable.

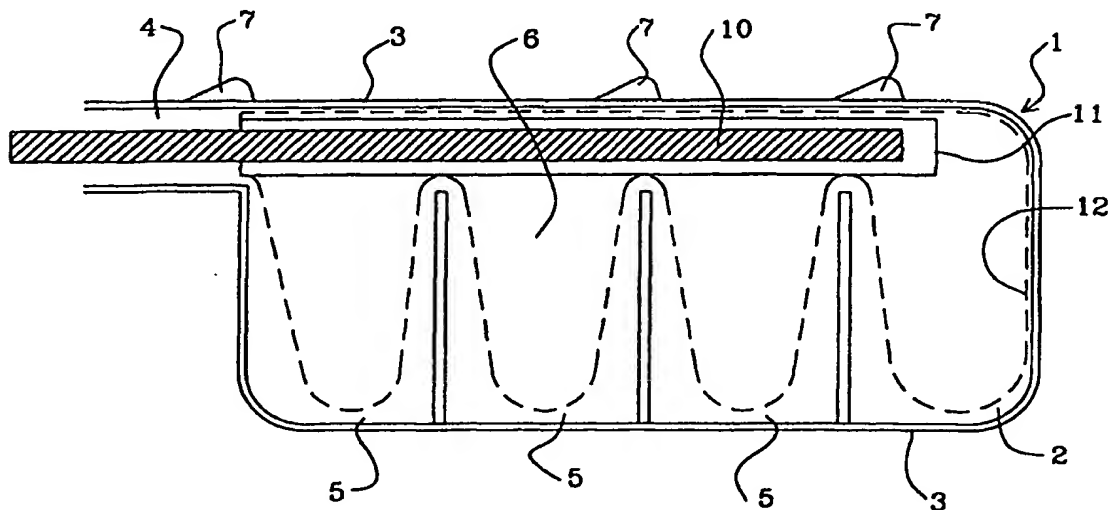




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>7</sup> :</b> <b>B60R 21/16</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 00/38954</b> <b>(43) International Publication Date:</b> 6 July 2000 (06.07.00)
<b>(21) International Application Number:</b> PCT/SE99/02460 <b>(22) International Filing Date:</b> 22 December 1999 (22.12.99) <b>(30) Priority Data:</b> 9828701.4      24 December 1998 (24.12.98)      GB <b>(71) Applicant (for all designated States except US):</b> AUTOLIV DEVELOPMENT AB [SE/SE]; S-447 80 Vårgårda (SE). <b>(72) Inventors; and</b> <b>(75) Inventors/Applicants (for US only):</b> VALKENBURG, Simon [NL/CA]; 579 Christina Crescent, Windsor, Essex, Ontario NPG 2M3 (CA). PITZER, Norbert [DE/DE]; Karl-Theodor-Strasse 28, D-85757 Karlsfeld (DE). <b>(74) Agent:</b> MEULLER, Erik; Autoliv Development AB, S-447 83 Vårgårda (SE).		<b>(81) Designated States:</b> DE, JP, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

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CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakhstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		



A method of fabricating an air-bag and an air-bag fabricated by the method

**THE PRESENT INVENTION** relates to a method of fabricating an air-bag and more particularly relates to an air-bag which, when inflated, is intended to be located between the head or body of the driver or front-seat occupant of the motor vehicle and the adjacent window. Such an air-bag may be termed a side-curtain and may be adapted to be inflated in the event that a side impact or roll-over situation should occur. A side-curtain may extend adjacent the head of the driver or front seat occupant of the motor vehicle, or may extend from the front of the vehicle to the rear of the motor vehicle, along the side of the vehicle, thus providing protection, not only for the driver or front seat occupant of the vehicle, but also for an occupant of the rear seat of the vehicle.

A side-curtain has to be deployed extremely rapidly if it is to provide protection in the event that a side impact should occur and consequently the side-curtain is inflated by injecting a large quantity of gas into the side-curtain very rapidly. The inflation is consequently violent, and the fabric may stretch at certain points.

In order to improve the gas-tightness of the fabric that makes an air-bag, it is conventional to provide the fabric with a coating of a sealant material such as a silicone rubber. In certain air-bags, such as air-bags intended to provide protection



for the driver or front seat occupant of the vehicle in the event that a front impact should occur, the air-bag is initially fabricated with the coating on the exterior of the air-bag, and then the air-bag is turned inside-out before being installed in the motor vehicle so that the coating is then on the interior of the air-bags. In the event that the air-bag is inflated, the gas that is injected into the air-bag tends to urge the coating into firm contact with the yarns constituting the fabric from which the air-bag is made, ensuring that any small gap that might exist between the yarns is sealed, consequently ensuring the integrity and gas-tightness of the air-bag. This is important, since in many instances an inert gas of low atomic weight is utilised to inflate the air-bag, and such a gas can easily pass through very small interstices between adjacent yarns. The coating also protects the fabric from the hot gas that maybe present in the air-bag when it is inflated. The strength of the fabric maybe reduced if the fabric is not protected from the hot gases.

In the case of a side-curtain, however, the air-bag is of a complex form and can not readily be turned inside-out. Consequently, the coating has to be applied to the exterior of the air-bag. This means that the pressure of gas present within the air-bag when it is inflated tends to dislodge the coating from the exterior of the air-bag, rather than press the coating more firmly into the interstices of the fabric. Also, as the bag is inflated the fabric from which the bag is made may stretch, especially in areas where high stresses are applied to the bag, and this may cause the coating to become dislodged from the fabric. For these reasons the coating is often relatively heavy and may be applied at a rate of 130 grams per square metre. This not only increases the weight of the air-bag, but substantially increases the cost, since the silicone rubber material is expensive. Also the lack of an internal coating means that the fabric of the air-bag will not be protected from the hot gasses.



It has been found that the silicone rubber applied to the exterior of the air-bag provides various disadvantages in that the silicone rubber is tacky and therefore exerts a high friction. Consequently, during deployment of the air-bag, the air-bag may stick to the glass or the material forming the "B"-Post of the vehicle, thus leading to distortion of the air-bag during the inflation process. Should the air-bag contact the passenger or occupant of the vehicle during the inflation process, the air-bag may impart an abrasion wound.

The present invention seeks to provide an air-bag in which the disadvantages of the exterior-coated air-bag as described above are obviated or reduced.

According to one aspect of this invention there is provided a method of fabricating an air-bag, the method comprising the steps of forming a bag from at least one layer of fabric, introducing a sealant into the bag and blowing the sealant into contact with the interior of the bag with a propellant gas so that the sealant material forms a sealant layer on the interior of the bag.

In one embodiment the sealant is in the form of a parison of a synthetic polymer material carried on a mandrel, said blowing step consisting of injecting said propellant gas through the mandrel.

Conveniently the parison is coated with adhesive.

In an alternative embodiment the sealant is introduced into the bag in the form of an aerosol or a suspension of powder in the propellant gas.

Preferably the sealant is formed of polyamide, polyester, polyvinylchloride or polyurethane silicone.





Conveniently the bag is heated as the sealant is blown into contact with the interior of the bag.

Advantageously the propellant gas is heated.

Preferably the sealant layer is a reinforcing layer.

Conveniently the air-bag is a side-curtain air-bag.

The invention also relates to an air-bag when fabricated by a method as described above.

According to another aspect of this invention there is provided an air-bag comprising a bag formed from a layer of fabric, the interior of the air-bag being provided with a sealant layer.

Conveniently the sealant layer is a reinforcing layer.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a diagrammatic view of a simple embodiment of air-bag in accordance with the invention during the manufacturing process, and

FIGURE 2 is a corresponding view of an alternative embodiment of the invention.



Referring now to Figure 1 of the accompanying drawings an air-bag 1 which is in the form of a side-curtain, is formed from two super-imposed layers of fabric 2 inter-connected by a plurality of seams 3 which inter-connect selected areas of the upper and lower layers of fabric forming the air-bag 1. The seams 3 define a gas flow duct 4 extending substantially parallel with the upper edge of the bag, and also define a plurality of substantially vertical parallel spaced cells 5, each of which communicate, by means of a communication region 6, with the gas flow duct 4. The air-bag 1 is also provided with a plurality of protruding lugs 7 which protrude from a position adjacent the gas flow duct 4 by means of which the air-bag may be mounted in position in a motor vehicle.

The air-bag, as thus far described, is formed from an appropriate fabric which may, for example, be a conventional fabric woven from yarns or fibres made from polyamide, polyester, polyvinylchloride or some other appropriate synthetic material, although it is envisaged that the fabric may be knitted or non-woven. The seams 3 may be formed by stitching together the super-imposed layers of fabric, although it is preferred that the seams are fabricated by weaving together threads from the upper layer of fabric together with threads from the lower layer of fabric in selected regions to form the seams, generally as described in WO 90/09295.

Following the initial fabrication of the bag, a reinforcing sealant coating is applied to the interior of the bag. The reinforcing sealant coating is applied to the interior of the bag by forming, on an hollow air injecting mandrel 10 a parison of a plastics material 11, such as a polyamide, polyester or polyvinylchloride material, or polyurethane silicone with the parison being in a substantially plastic state.

The exterior of the parison may be coated with adhesive. The mandrel, together with the parison, is inserted into the gas flow passage 4 of the bag. To



facilitate insertion of the mandrel 10 and the parison 11, the gas flow passage 4 may be gently inflated or may be held in an open position by appropriate mechanical means. For example, vacuum suction means may be applied to opposite sides of the exterior of the portion of the air-bag 1 that define the gas flow passage 4, thus separating the layers of fabric that form the gas flow passage 4 facilitating the insertion of the mandrel and the parison into the gas flow passage.

Once the mandrel and parison have been inserted into the gas flow passage, to occupy the position illustrated in Figure 1, air or other propellant gas is injected through the hollow mandrel in order to inflate the parison. An intermediate stage during inflation of the parison is indicated by the dotted line 12 shown in Figure 1. The parison is seen to be inflating to fill not only the gas flow passage 4, but also the cells 5. Thus, the parison is blown into the interior of the air-bag. The parison expands until the parison contacts the whole of the area of the fabric 2 that defines the interior of the air-bag 1. The parison is then adhered to the fabric, and forms a reinforcing sealant layer on the interior of the bag. The step of adhering of the parison of the fabric may be facilitated by the application of heat to the exterior of the bag, depending upon the nature of the polymer material utilised for the parison, and the nature of the adhesive, if an adhesive is provided. Also the gas injected through the mandrel to inflate the parison maybe heated.

Referring now to Figure 2 of the accompanying drawings, an air-bag is shown which is the same as the basic air-bag shown in Figure 1 as described above when mentioning the reference numerals 1 to 7.

Figure 2 illustrates a fine elongate mandrel 15 that has been introduced into the air-bag through the gas flow duct 4. The mandrel 15 is provided with a plurality of apertures 16 at positions spaced along the length of the mandrel. A propellant gas, which may be warmed or pre-heated, is introduced into the



mandrel. Entrained with the propellant gas is a sealant material which, on leaving the mandrel, forms an aerosol or a powder suspension 17 with the propellant gas. The aerosol or powder suspension is therefore injected into the interior of the air-bag by the warm propellant gas. The interior of the air-bag inflates during this process, due to the continuous flow of the propellant gas. Whilst, as mentioned above, the propellant gas may be heated, equally the air-bag itself may be heated by performing the described procedure within a heat chamber or oven.

The propellant gas initially flows out of the air-bag through the fabric material, which is porous, but the sealant material which forms the aerosol or powder suspension becomes entrapped by the fabric and thus this material covers the inner side of the air-bag. Due to the elevated temperature of the gas and/or the elevated temperature of the bag itself, the sealant material that has become trapped on the inner side of the air-bag forms a sealant layer with reinforcing properties.

Thus a reinforcant sealant coating made of a material such as polyamide, polyester, polyvinylchloride or polyurethane silicone is established on the interior surface of the air-bag.

It is envisaged that following the procedure described above, the material that initially formed the parison will constitute a reinforcant sealant coating which covers the whole of the interior of the air-bag. The air-bag itself, however, does not suffer from any additional stiffness and can thus be folded in a conventional manner.

It is to be appreciated that the reinforcing sealant coating is provided on the interior of the air-bag, thus protecting the fabric to be utilised in the fabrication of the air-bag from the heat of any gas injected into the air-bag from the gas generator during inflation of the bag. The fabric 2 provides the bag with substantial





strength, and should there be any tendency for interstices to develop between the fibres of the fabric, the reinforcing and sealant film will be forced into those interstices, tending to seal the interstices.

It is envisaged that it will be a practicable matter to fabricate bags with a reinforcing and sealant layer of a predetermined thickness. Because the air-bag is inflated during the process of manufacture, the integrity of the sealant film can be checked at that stage.

It is envisaged that a preferred embodiment of an air-bag, as described above, may be able to withstand an internal pressure of up to 10 bars and also high temperatures of up to 600°C, whilst the manufacturing costs will be acceptable.

In the present specification "comprise" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.



## CLAIMS:

1. A method of fabricating an air-bag, the method comprising the steps of forming a bag from at least one layer of fabric, introducing a sealant into the bag and blowing the sealant into contact with the interior of the bag with a propellant gas so that the sealant material forms a sealant layer on the interior of the bag.
2. A method according to Claim 1 wherein the sealant is in the form of a parison of a synthetic polymer material carried on a mandrel, said blowing step consisting of injecting said propellant gas through the mandrel.
3. A method according to Claim 2 wherein the parison is coated with adhesive.
4. A method according to Claim 1 wherein the sealant is introduced into the bag in the form of an aerosol or a suspension of powder in the propellant gas.
5. A method according to any one of the preceding Claims wherein the sealant is formed of polyamide, polyester, polyvinylchloride or polyurethane silicone.
6. A method according to any one of the preceding Claims wherein the bag is heated as the sealant is blown into contact with the interior of the bag.
7. A method according to any one of the preceding Claims wherein the propellant gas is heated.



8. A method a method according to any one of the preceding Claims wherein the sealant layer is a reinforcing layer.
9. A method according to any one of the preceding Claims wherein the air-bag is a side-curtain air-bag.
10. An air-bag when fabricated by a method according to any one of the preceding Claims.



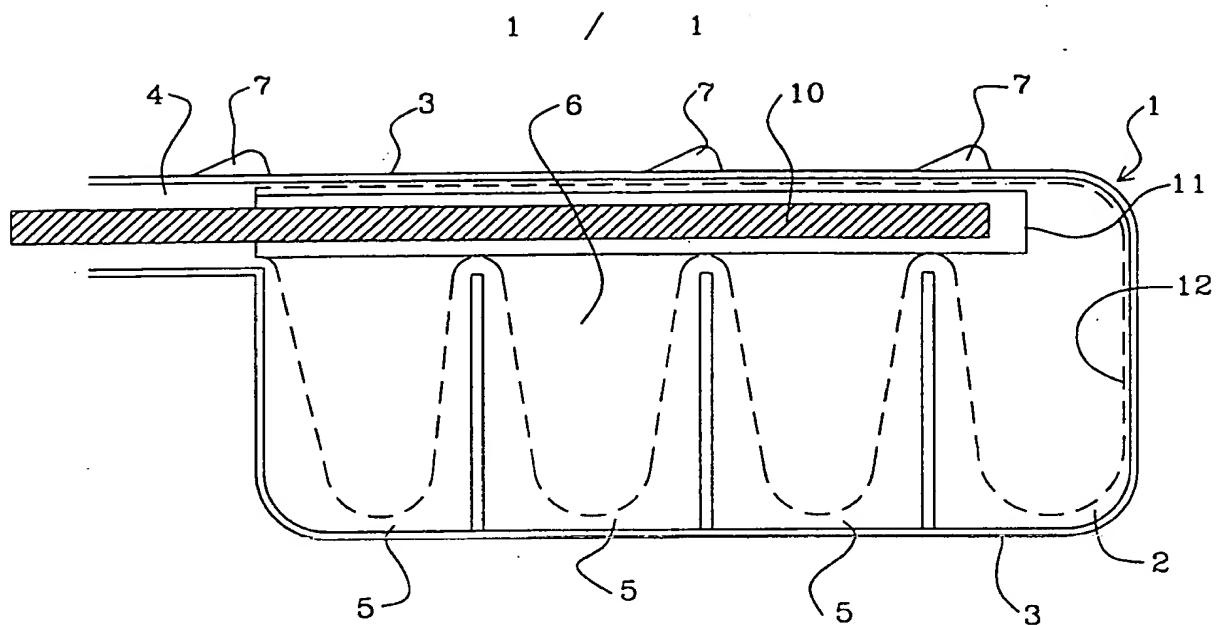


FIG 1

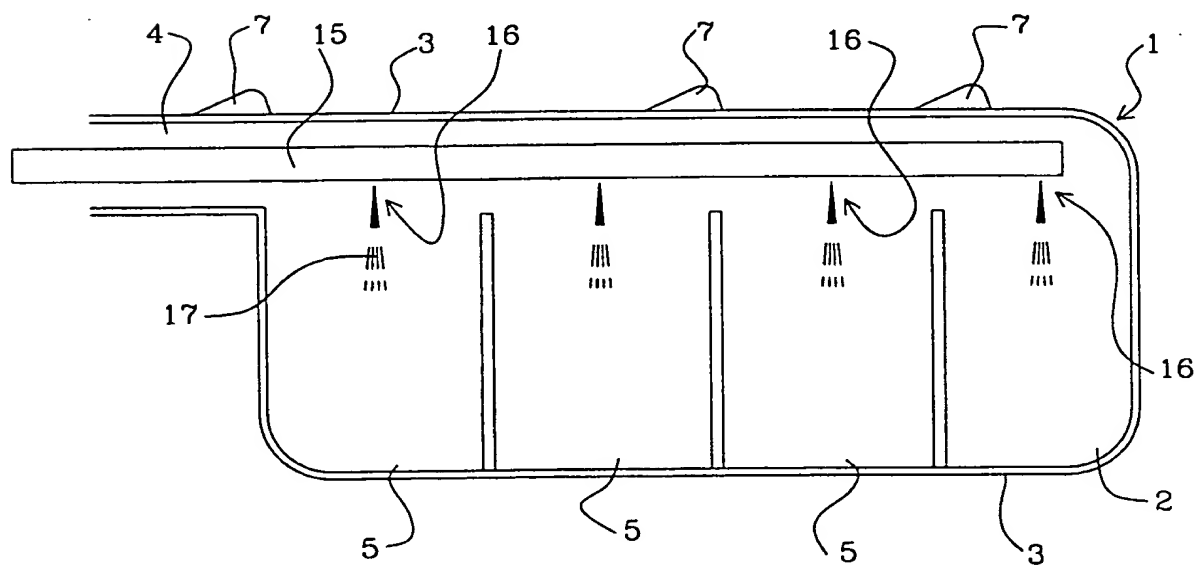


FIG 2





## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/SE 99/02460

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B60R 21/16

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B60R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9830748 A1 (FOV FABRICS AB), 16 July 1998 (16.07.98) --	1-10
A	US 5259645 A (HIRABAYASHI ET AL.), 9 November 1993 (09.11.93) --	1-10
A	US 5076975 A (DAVIS), 31 December 1991 (31.12.91) --	1-10
A	EP 0535649 A1 (SHIN-ETSU CHEMICAL CO LTD), 7 April 1993 (07.04.93) --	1-10



Further documents are listed in the continuation of Box C.



See patent family annex.

## \* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Date of the actual completion of the international search

26 April 2000

Name and mailing address of the ISA  
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Date of mailing of the international search report

27 -04- 2000

Authorized officer

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/02460

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0866164 A1 (DOW CORNING LTD), 23 Sept 1998 (23.09.98)  -- -----	1-10



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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
**PCT/SE 99/02460**

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				SE	9604661 A	20/06/98
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US	5076975	A	31/12/91	US	4994225 A	19/02/91
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